

ADRENAL GLAND

In the endocrine system, Adrenal gland is very ~~much~~ important gland lying on upper pole of each kidney. This gland was first of all described by EUSTACHIUS (1563). CUVIER (1805) recognised that each gland consists of an outer cortex and an inner medulla region. The two parts are structurally, functionally and embryologically distinct. The another name of adrenal gland is suprarenal gland as the glands are located on the superior poles of the kidney.

HEIGHT! → Each weighs about 4 gm. At birth it weighs about 8 gr and with the passing of age it gradually decreases in size. On the other part the total weight of gland is about 10 gm in weight.

SIZE! - The right gland is smaller and looks like a coated hat and the left one is roughly crescentic & usually larger.

ANATOMY! - 1. Each adrenal is enclosed in a capsule of areolar tissue and consists of two distinct regions the adrenal cortex and the adrenal medulla.

2. The outer cortex comprises about 80% of the gland. It is of mesodermal origin. It is derived from the mesodermal coelomic epithelium covering the anterior part of the mesonephros.
3. It is composed of large lipid laden epithelial cells, known as foam cells, arranged in irregular strands.
4. The cortex consists of polyhedral cells with well defined nuclei, typical mitochondria, Golgi apparatus and numerous lipid granules.

⑤ The cells of adrenal cortex, according to Fawcett (1969) contains large amount of smooth endoplasmic reticulum which are presumably involved in the synthesis of steroid hormones.

On the basis of arrangements and structure of the cells 3 following zones may be recognised from outside inwards - 1) Zona glomerulosa 2) Zona fasciculata 3) Zona reticularis respectively. New cells are formed in the Zona glomerulosa and older cells die in the Zona reticularis. The newly formed cells undergo successive transformation into middle and inner layer before being devoured by reticulo-endothelial cells.

① Zona glomerulosa :- The Zona glomerulosa is a thin layer of cells that lies just underneath the capsule. It constitutes about 15% of the adrenal cortex. These cells secrete mineralocorticoid aldosterone. The secretion of these cells is controlled mainly by the extracellular fluid concⁿ of angiotensin II and potassium both of which stimulate aldosterone.

2) Zona fasciculata :- Zona fasciculata is the middle and widest layer, constitutes about 75% of the adrenal cortex. It is made up of polyhedral cells arranged in radiating columns. The cells are proportionally larger, containing pigment granules upon which the brownish-yellow colour of the cortex depends. The cells are perpendicular to the surface and contain lipid droplets (liposomes). Nuclei are larger and less dense than those of the Zona glomerulosa. This layer is responsible for the secretion of glucocorticoids.

3. Zona reticularis :- The inner layer Zona reticularis as the name suggests, is composed of net like cells cords bordering the medulla. The meshes of network are filled up with sinusoids lined by reticulo-endothelial cells.

Glucocorticoids :->

OH - at C11 position. These are C21 steroid with =O at C20. They have gained their name because they exhibit an important effect on increasing blood sugar concn. However, they have additional effects on both proteins and fat metabolism. Examples of glucocorticoids are Cortisone, Hydrocortisone, Corticosterone, dehydrocorticosterone etc.

The synthesis of adrenocorticoids takes place in endoplasmic reticulum and mitochondria. The parent cholesterol is stored in the form of cholesterol ester. The free cholesterol is converted to pregnenolone by pregnenolone synthetase in the mitochondria. Pregnenolone is in fact a pivot in the synthesis of all the adrenocorticoids.

Adrenocorticoids are mostly bound with plasma proteins. An α globulin or transcortin binds with cortisone and corticosterone. A β -globulin sex hormones binding globulin or gonadal steroid binding globulin transport oestradiol and testosterone.

Function of glucocorticoids :- Glucocorticoids act on various tissue and performs many functions. They are metabolically antagonistic to insulin. It promotes gluconeogenesis and in this way it maintain the glycogen reserves in liver, heart and skeleton muscles.

Protein metabolism :- Glucocorticoids promotes breakdown of protein in peripheral tissues. Their deficiency results in retarded growth due to loss of appetite and reduction in amino acid absorption by the intestine.

Lipid metabolism :-> Glucocorticoids inhibits lipid synthesis in peripheral tissues by inhibiting glucose uptake. This results in reduced formation of glycerophosphate that is required for reesterification of fatty acids.

The layer is destined for the secretion of androgen, estrogen and small amount of glucocorticoids under the influence of ACTH. Cortex is very rich in vitamins especially the zinc fasciculate.

Medulla - The medulla and cortex are separated by a thin layer of connective tissue. In mammals this region is quite small comprising only 20% of the entire gland. The cells of the medulla assemble in rounded group or short masses making a column with many intermingling blood capillaries. The medulla is composed of sympathetic ganglion cells which form no post ganglionic fibres. Medullary cells are essentially neurosecretory cells because they are stimulated by preganglionic sympathetic fibres to produce the hormones adrenaline and noradrenaline. Medullary cells have a special affinity for Ca compounds such as K_2CO_3 and chromic acid and they are therefore, also referred as chromaffin cells. The medulla is composed of two types of catecholamine secreting cells, nerve cells, nerve fibres, blood capillaries etc.

FUNCTIONS -

- * Function of Adrenal Cortex → Crude extracts of the adrenal cortex & those of cortex. Corticin is composed of 3 types of corticosteroids, two of which are steroid and the third one is of non-steroid composition. The steroidal hormones contain cyclopentanoperhydrophenanthrene nucleus and are derived from cholesterol. Adrenal cortex secretes about 30 hormones of which 14 are chemically known and 16 are of unknown chemical nature.